NOVEMBER 2017 Update

Small Cells Forecast

Major changes to the forecast this quarter include:

1. We have received additional inputs that led us to conclusion that DRS shipments were less than we had originally noted. We have revised our projections from the past couple of years and reduced the growth projection as major indoor venues have been covered.

2. We have adjusted for a quicker elimination of older family of 3G outdoor small cell base stations from our model. The Carrier Outdoor forecast reflects this change along with the reduction from outdoor portion of DRS shipments in China and southeast Asia.

3. The 3G residential femtocell lifecycle has been extended out a couple of more years as some CDMA operators continue to leverage femtocells for coverage solution. With a looming T-Mobile/Sprint merger, we expect CDMA usage will eventually taper off, but expect LTE femtocells to remain a meaningful coverage solution for the combined entity going forward.

4. Residential femtocell adoption of CBRS is forecasted to ramp up in 2020, after the PAL auction in 2019 and the initial round of carrier outdoor deployments before extending the additional capacity augmentation through indoor deployments via femtocells. Due to possible complexity and higher cost of SAS interoperability, we have artificially kept the adoption of CBRS on femtocells to minimal. If mobile operators decide to ramp up femtocells for "inside-out" strategy of expanding mobile coverage and capacity, this figure can possibly increase greatly.

5. The forecast of Carrier Outdoor deployments of CBRS small cells has been increased from our previous projection to reflect multiple uptake of CBRS radio deployments by fixed wireless ISPs, cable operators and mobile/telco operators. While the fixed wireless ISPs will lead the initial uptake, the mobile and cable operators are expected to dominate deployment of CBRS small cells for mobile capacity expansion.

6. Carrier deployment of CBRS multiband indoor small cells has been greatly reduced as indoor deployments of CBRS radios are expected to be led by neutral hosts and enterprises. Moreover, the carrier indoor deployment is expected to start later in 2019 after outdoor deployments for mobile capacity augmentation, as per pending CBRS rule changes towards a longer-term licensing duration and size which will likely favor larger carriers vs. enterprises.

7. We have aligned our Small Cell forecast with a more detailed CBRS forecast that takes a closer look at multiple business models and stakeholders that are expected to drive the growth. Overall, we are expecting a slower initial ramp but higher shipment of CBRS

infrastructure by multiple stakeholders including cable operators and neutral host providers. (Note: The *2017 CBRS* report has just been released this week.)

8. After a flurry of carrier trials, we are seeing less activity on LAA deployments. We have adjusted for a slower ramp up of LAA in carrier deployments. Mobile Experts continue to believe LAA will be leveraged in "Gigabit LTE" deployments. In the USA, CBRS appears more likely choice for major operators as they look to increase network capacity.

9. We have received additional inputs on carrier shipments and reflected those in Market Share updates. Overall, Mobile Experts is seeing greater small cell shipment activities among the mobile carriers as they prepare for denser networks that can take advantage of massive MIMO and higher spectrum bands even before we get to millimeter wave spectrum deployments in earnest.